Biotools: Indicators for Biodiversity Outcomes of Grazing Practices in the Australian Rangelands

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Biotools : indicators for biodiversity outcomes of grazing practices in the Australian rangelands

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Introduction Australia's tropical savanna rangelands are one of the most intact and best condition savannas in the world , and have significant biodiversity values (e .g . habitat for 50% of Australia's bird fauna) (Woinarski *et al* . 2007) . Livestock grazing is the dominant land use ; therefore grazing land management will have a major influence on the ability of rangelands to maintain biodiversity . For graziers , maintaining rangeland condition (perennial grass cover and capacity to produce forage) is a goal for sustainable management . Historically , rangeland condition was presumed a surrogate for biodiversity condition , but it is now recognised that this is not entirely true (Fisher and Kutt , 2007) . The Biotools project is investigating the relationship between biodiversity pattern and a range of condition metrics , and is developing a framework for land managers to learn about biodiversity on their land , and gain new perspectives about their role as land stewards .

Materials and methods Twenty case study properties , throughout northern Queensland in the Northern Gulf , Southern Gulf , Burdekin Dry Tropics , Desert Channels and Far North Queensland regions , form the basis for this study . At each property 10-50 1-hectare sites were selected to represent a range of typical condition states (variation in ground cover , fire pattern , tree density , vegetation diversity) . At each site vertebrate fauna was sampled using trap and release , observation and active searching methods . The relationship between biodiversity , habitat variables and condition metrics was investigated to assess universal and idiosyncratic relationships across taxa , land types , management and region .

Results The relationship between bird , reptile and mammal richness , abundance and diversity indicated varying and inconsistent relationship between typical measures of land condition (e .g . dry matter yield , perennial ground cover , tree basal area , stem counts) . For example , bird species richness showed a quadratic relationship with dry matter yield , whereas mammal and reptile species richness was positive and linear (Figure 1) . A test of four typical condition metrics (Stocktake = rangeland condition , Patchkey = soil and hydrological function , BioCondition = habitat values , Landsat = temporal ground cover trends) , indicated that only the metric specifically designed to assess biodiversity condition , was able to account for variation in species composition across a range of site condition states (Table 1) .

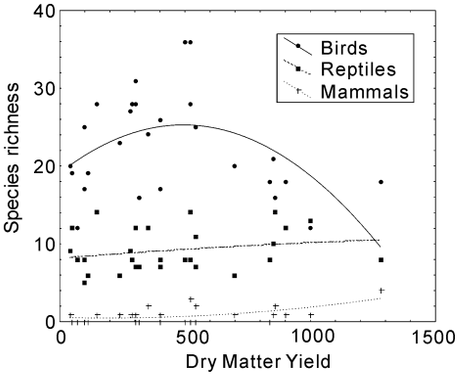

Figure 1 *Relationship between ground cover (as dry matter yield) and fauna species richness at 50 sites in the Northern Gulf region .*

Table 1 *Analysis of similarly between four land condition classifications , each with four categorisations (A to D , with A indicating "good" , and D "poor") and bird , reptile , mammal and plants species composition at 60 sites in the Desert Uplands region . The general relationship and the comparison between the most contrasting condition states (AvsD) are presented .*

Classification	n	Birds	Rept	Mamm	Plants
Stocktake	4	ns	0 .12*	ns	ns
(A vs D)		*ns*	*ns*	*ns*	*ns*
Patchkey	4	ns	ns	ns	ns
(A vs D)		*0 .64***	*ns*	*ns*	*ns*
BioCondition	4	0 .16**	0 .10*	0 .08**	0 .13**
(A vs D)		*0 .78****	*ns*	*0 .35***	*0 .75***
Landsat trend	4	ns	ns	ns	ns
(A vs D)		*ns*	*ns*	*ns*	*ns*

(* = P<0 .05 , ** = P<0 .01 , *** = P<0 .001)

Conclusions Traditional measures of rangeland condition were not directly related to biodiversity condition . We argue , therefore , that their use is not equated with sustainable environmental management . The Biotools project provides more accurate information on land condition and biodiversity , thereby providing a tool to help land stewards manage and monitor biodiversity values . Going forward , one key challenge for the Biotools project is to find the balance between information that is simple enough for all land managers to use , but is able to capture ecological complexity .

References

Fisher , A and Kutt , A . (2007) . Biodiversity and land condition in tropical savanna rangelands . *Tropical Savannas CRC* , Darwin .
Woinarski , J , Mackey , B , Nix , H . and Traill , B . (2007) . *The Nature of Northern Australia* . ANU Press , Australia .